Claims

1. A method of operating a fuel cell power plant having fuel cells each comprising a membrane electrode assembly including a proton exchange membrane with cathode and anode electrode catalysts on opposed surfaces thereof, a support plate, at least a substantial portion of which is hydrophilic, adjacent to each catalyst, and a hydrophilic porous water transport plate having passages for reactant gas and passages for coolant adjacent to each support plate, said method comprising:

during normal operation in which said fuel cell power plant supplies electric power to a load, maintaining a pressure of coolant in said coolant passages about 14 kPa - 21 kPa (2 psi - 3 psi) below the pressure of reactant gas in said reactant gas passages, thereby to allow only small volumes of water migrating to or from said reactant gas passages and said support plates;

during a shutdown procedure, reducing the pressure differential between the coolant and reactant gas so that said support plates are filled with coolant to about 50% - 80% of their coolant capacity; and

finally, draining water from the coolant passages. .

2. A method according to claim 1 wherein:

said support plates are filled with coolant to about 70% of their coolant capacity.

3. A method according to claim 1 wherein:

said support plates are filled with coolant to about 50% of their coolant capacity.

4. A method according to claim 1 comprising:

during said shutdown procedure, adjusting the pressure of coolant in said water transport plates to between 3 kPa (0.44 psi) and 6.5 kPa (0.94 psi) below the pressure of reactant gases in said water transport plate.

5. A method according to claim 4 wherein said pressure differential is adjusted to between about 4 kPa (0.58 psi) and 5.2 kPa (0.75 psi).

6. A method according to claim 3 wherein said pressure differential is adjusted to between about 4.8 kPa (0.7 psi).

7. A method according to claim 1, further comprising:

providing in said fuel cells support plates which have substantially uniformly hydrophobic regions in a hydrophilic substrate to cause said substrate to be 10% - 40% hydrophobic and 60% - 90% hydrophilic.

8. A method according to claim 6 wherein:

said step of providing causes said substrate to be about 30% hydrophobic and about 70% hydrophilic.